

# Concrete Pipe **Insights**

A Message from the American **Concrete Pipe** Association

## Hydraulics: Check the Comparisons

Values for the coefficient of roughness of pipe have been investigated for many years. Extensive data are available on this subject. Presently accepted values for the coefficient of roughness may appear to be sufficient but, an understanding of how these values were determined is important. The value that is needed is the one which will accurately predict the hydraulic properties of the field installations during service life.

Research conducted independently at Utah State University and other locations confirm the following Manning's  $n$  laboratory values:

Concrete	0.009 - 0.010
PVC (Solid Wall)	0.009 - 0.010
Corrugated HDPE with Liner	0.009 - 0.015
Spiral Rib Metal	0.012 - 0.013

The difference between laboratory test values of Manning's  $n$  and accepted design values is significant. Laboratory results are usually obtained by using clean water and straight, new pipe sections without bends, manholes, debris, or other obstructions.

The concrete pipe industry promotes its product as having design values of 0.012 and 0.013 which are historically and widely accepted in the engineering community. The 20 to 30 percent "design factor" included by the concrete pipe industry takes into account the differences between laboratory testing and actual installed conditions. The use of design factors is good engineering practice and, to be consistent for all pipe materials, the applicable Manning's  $n$  laboratory value should be increased a similar amount in order to arrive at design values.

The flexible pipe industry, in particular plastic and spiral rib metal pipe, are promoting laboratory values for design purposes. In fact, the laboratory values

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being promoted by these manufacturers are the lowest to mid- range values of the test results. In addition to the laboratory versus design differences noted above, the pipe is not subjected to any loads in the laboratory test. This is very important with regards to flexible pipe which will deflect when subjected to loads. Also, commercially supplied joints were not used in the tests of corrugated HDPE pipe with an interior liner. Another consideration for hydraulic comparisons is that plastic pipe will generally have a smaller inside diameter (less than nominal) than concrete pipe.

Concrete pipe is also more efficient in inlet control situations due to its groove end (bell), which results in a lower entrance loss coefficient. In some cases this allows designers to use smaller diameter concrete pipe when compared to other pipe.

It is therefore important, in any discussion comparing hydraulic efficiencies of various pipe materials, to ensure that the stated Manning's  $n$  values are design values rather than laboratory values.

